A PARALLEL FULL SPACE SQP LAGRANGE-NEWTON-KRYLOV-SCHWARZ METHOD FOR FLOW CONTROL PROBLEMS

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Optimization problems constrained by nonlinear equality partial differential equations have been the focus of intense research in scientific computation lately. The state-of-the-art methods for the parallel numerical solution of such problems involve sequential quadratic programming (SQP), with either reduced or full space approaches.

In this talk we propose a class of parallel full space SQP Lagrange-Newton-Krylov-Schwarz (LNKSz) algorithms. In LNKSz, a Lagrangian functional is formed and differentiated to obtain an optimality system of nonlinear equations. Inexact Newton's method with line search is then applied and at each Newton's iteration the Karush-Kuhn-Tucker system is solved with a Krylov subspace method preconditioned with overlapping additive Schwarz.

We apply LNKSz to some boundary control problems of steady-state flows of viscous incompressible fluids described by Navier-Stokes equations in velocity-vorticity formulation. We propose the application of LNKSz to flow control problems as a natural extension to the successful application of NKSz to flow simulations. We report the results of a PETSc based implementation of LNKSz for different combinations of Reynolds numbers, grid sizes and number of processors.